

# X-ray data validation and analysis on the EXL-50 spherical torus

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EXL-50 is a solenoid-free spherical torus that uses electron cyclotron wave (ECW) as the primary heating source. The typical range for plasma density is between  $1 \sim 10^{18} \text{ m}^{-3}$  and the ECW generates superthermal electrons that can be accelerated to high energies by multiple resonance layers in the torus. These high-energy electrons have low collisionality in the low-density plasma and are lost on the limiters, the central pole, and the vacuum vessel wall in large quantities, producing intense thick-target X-rays. These X-rays and their secondary emissions, such as Compton scattering and fluorescence, can dominate the thin-target emissions from the plasma if the diagnostic setup is not carefully designed. To obtain the thin-target bremsstrahlung with soft and hard X-ray pulse height analyzer (PHA) systems on EXL-50, several measures are taken to improve the diagnostic systems, including thick lead shielding and dedicated collimation of light paths. The optical paths of both systems are scanned to estimate the radial emission profile. The X-ray data are compared with theoretical calculations and other diagnostic data and subsequently, a preliminary interpretation is given.

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